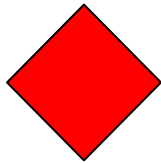


---

## 2.0 Chapter 2 – Project Scoping

Identifying the project limits and the model to be used on any project should be given careful consideration. The variety of projects that are typically conducted in Minnesota range from high level planning studies to project development to research. Each of these types of studies will have different levels of need for traffic analysis. Planning efforts may only require capacity analysis to determine the basic number of lanes, whereas project development type studies may have varying degrees of modeling requirements based on the location (urban versus rural) and the type of facility (interstate freeway versus trunk highways).

Before a project begins, a meeting should be held with the project manager, FHWA representative, and Mn/DOT traffic modeling expert to determine the scope of project including the model limits and time periods. This chapter provides an overview and guidance as to what should be considered in developing the scope for modeling a project.



Kick-off meeting with  
FHWA and Mn/DOT

### 2.1 Scoping Steps

The steps in scoping a modeling project begin with the purpose of the project. Is the project a new access to the interstate system, or is it a modification to an existing interchange? Where is the project located? Is it out-state or in the metro area? If it is in the metro area, is it near a systems interchange? These are the types of discussion questions that need to be considered when scoping the project. The following subsections will provide information and things to consider when scoping. The process will, in some fashion, use the following steps:

**Step 1: Identify Project Purpose**

**Step 2: Identify Limits of Analysis**

**Step 3: Select Model**

**Step 4: Estimate Data Collection Requirements**

**Step 5: Estimate Level of Effort**

**Step 6: Sensitivity Analysis**

#### 2.1.1 Step 1: Identify Project Purpose and Need

The purpose of the project goes a long way towards determining the scope of a traffic analysis. The first consideration is the type of project. Is the project a high level planning study that requires minimal analysis to determine basic roadway sizing, or is the study researching ramp meter strategies? The types of projects that this manual addresses are changes to the interstate freeway system, either new access or a modification to an

---

existing interchange. These types of projects will have a tight turn around because the subject interchange typically will be designed and constructed in the immediate future.

## **2.1.2 Step 2: Identify Limits of Analysis**

Once the purpose has been identified, careful consideration and deliberation is given to identifying limits to the modeling effort. The model limits are determined as early as possible in the design process. A meeting with FHWA, Mn/DOT's freeway modeling group, and the project manager should occur early to discuss the modeling limits. The discussion will involve identifying the area of influence around the project and to identify the boundary conditions.

### **2.1.2.1 Influence Areas**

The area of influence around the project includes adjacent interchanges that could be affected by the construction of the proposed project or future improvements to adjacent interchanges that could have an effect on how the proposed project is constructed. The influence area is close to the project and is based on the potential influence of the proposed construction. One of the requirements for access approval is to demonstrate that the proposed interchange project is compatible with the interstate plan. Therefore, the influence area includes at least one interchange on either side of the proposed interchange project. In the metro area where interchanges are closely spaced, the influence area may extend beyond the adjacent interchanges.

### **2.1.2.2 Boundary Conditions**

Boundary conditions are the limits to the model. Depending on the project location, the boundary condition could be the same as the influence area or it can extend beyond the influence area. Boundary conditions that extend beyond the influence area typically occur in very congested areas of the metro area. Due to the congestion, extended model limits are needed so that traffic conditions within the influence area can be replicated.

Determining boundary is based on the following:

- **Entering the influence area.** The boundary condition limits should be based on: where backups begin, ramp connections that affect weaving within the influence area, and any other operational situations.
- **Leaving the influence area.** The boundary condition limits should be based on: downstream congestion that backs up into the influence area, ramp connections that affect weaving within the influence area, and other operational situations.

Generally, the modeling limits for projects in out-state areas include one interchange on either side of the proposed construction project. Figure 2 illustrates this condition. Within the metro area, the model limits for a proposed project need to consider adjacent systems interchanges. Depending on the proximity of the proposed project to a systems interchange, the entire systems interchange may need to be modeled including portions of the intersecting freeway. Modeling systems interchanges, whether it is part of the analysis or if it is the subject of the analysis, needs to consider the "tails" of the freeways leading into it. Figure 3 illustrates metro modeling limits.

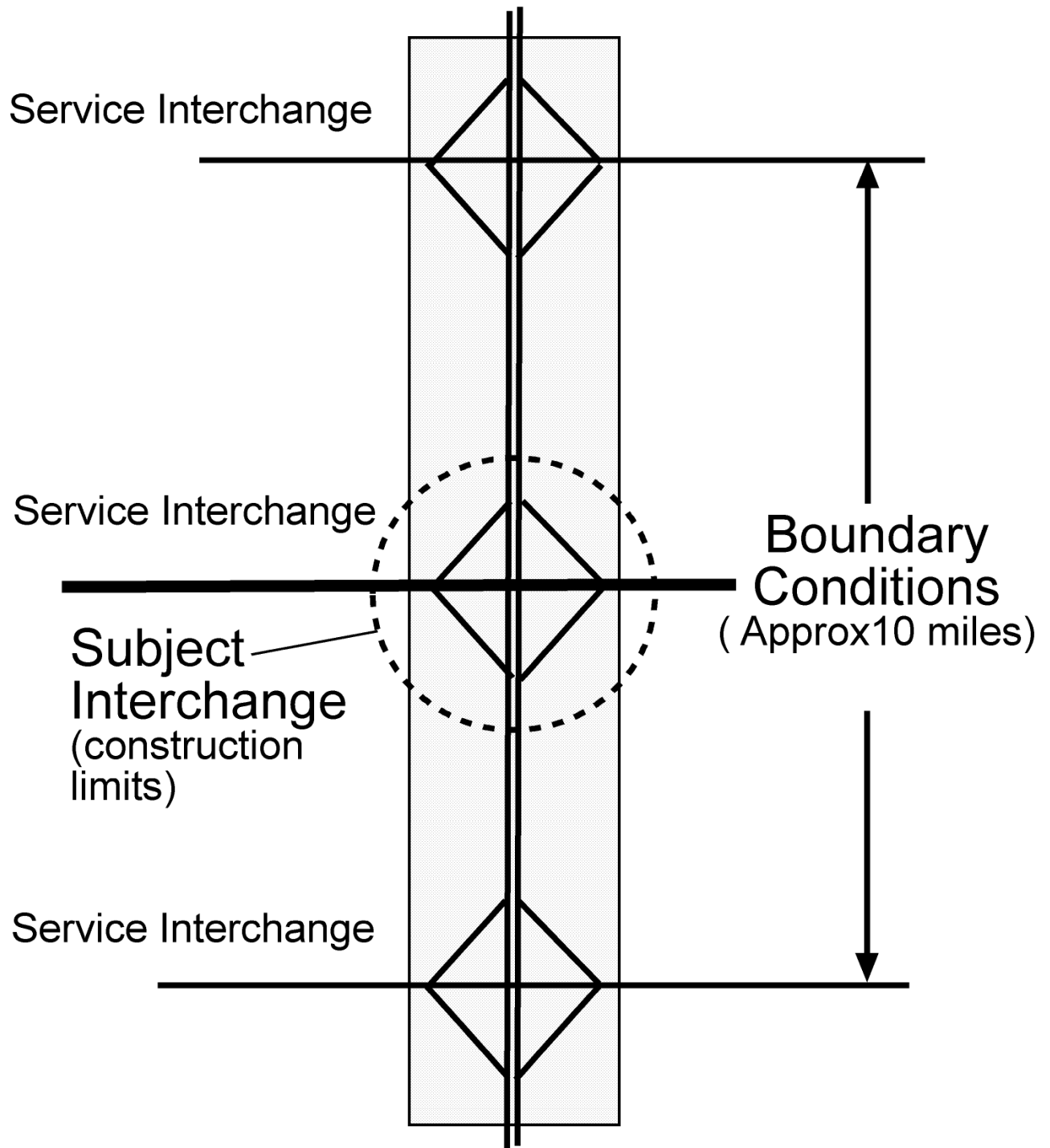


Figure 2 – Out-State Modeling Limits

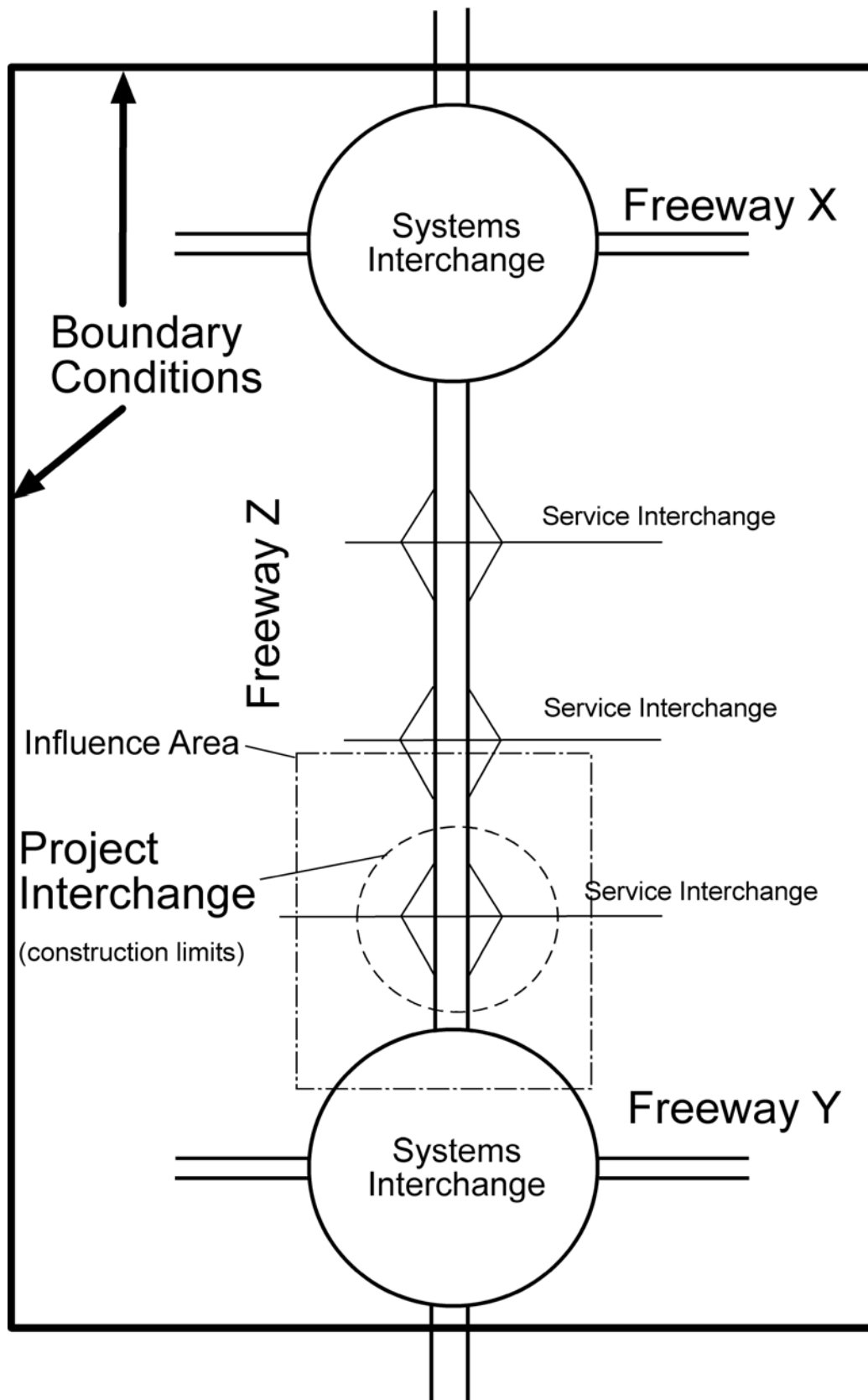


Figure 3 – Metro Modeling Limits

### 2.1.2.3 Choosing Model Time Periods

The length of the modeling period relates to the location of the project and the type of congestion that is experienced. Within the metro area, the congestion levels extend well beyond the peak hour. Based on modeling experiences in the last few years, it has become clear that the modeling period must be two to three hours to replicate congestion. Within the longer time periods, traffic flow rates must be adjusted every 15 minutes to reflect the build up to congestion and the recovery afterwards. Figure 4 below illustrates peak period conditions for I-35W near downtown Minneapolis. In out-state areas, peak traffic conditions could be less than one hour; in these cases, a single peak hour may be modeled.

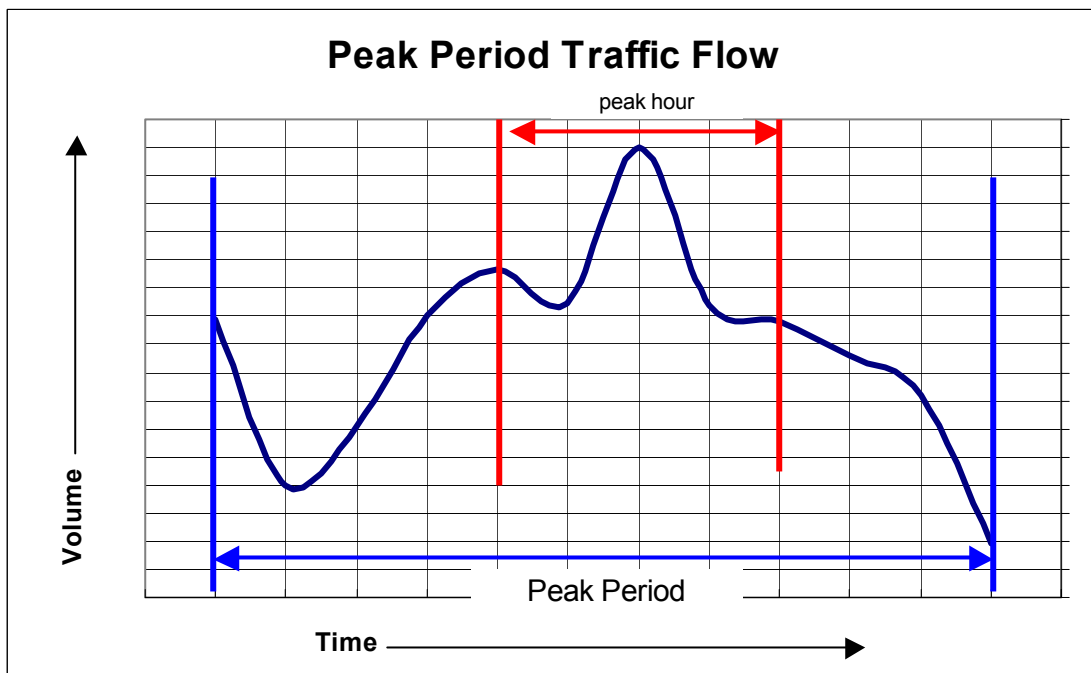


Figure 4 – Modeling Time Periods Sample

### 2.1.3 **Step 3: Select Model**

Selecting the appropriate model to use can depend on the purpose of the project as much as the complexity of the project. Also, within a project, multiple analysis methods may be used to provide a comparison or to initiate preliminary design work that will be analyzed in detail further into the study.

HCM techniques provide a good assessment of basic lane needs and provide an indicator of whether individual elements will operate adequately or not. If the HCM levels are poor, the micro-simulation analysis will likely be poor. However, if there are complexities in the system, like multiple weave sections within an area, the HCM methodologies will likely overestimate operations. This is where the micro-simulation approach is essential in the analysis.

---

All freeway projects involving modified or new access within the metropolitan area will require a micro-simulation analysis. Out-state freeway projects may require a simulation analysis depending on existing and/or projected traffic levels. It could also depend on the proposed project. For instance, is it a new interchange within 5 miles of an existing interchange?

Based on the complexity and type of project, assess what model should be used. In most cases, projects relating to the interstate system will require micro-simulation analysis. However, it may be necessary to also conduct a Highway Capacity Software analysis early in the project to allow the design process to proceed. The simulation model will then be used to evaluate and refine this design.

#### **2.1.4 Step 4: Estimate Data Collection Requirements**

Data collection requirements are discussed in detail in Chapter 3. The type of information that needs to be collected for simulation modeling includes traffic count information broken down into 15-minute intervals.

Based on the analysis limits and model selected, identify all data required. This will include traffic counts, speed runs, and assembly of information.

#### **2.1.5 Step 5: Estimate Level of Effort**

The level of effort for conducting a traffic analysis project is important at many levels. When a Mn/DOT project manager is developing a scope for a project, there should be a way to convey expectations of what is involved. Typically, the existing calibrated CORSIM models should take at least one month to prepare. This could be more or less depending on the complexity of the project. This time does not necessarily translate to staff hours. One must consider if there is time to wait for information, and if there needs to be time allowed for review of link node diagrams and model inputs. This should occur in small steps as opposed to all at the end. Rework as a result of not catching mistakes early on in the process can double the time and effort.

#### **2.1.6 Step 6: Sensitivity Analysis**

Sensitivity analysis is conducted on the preferred alternative to identify the capacity of the alternative and to further fine-tune the design. The conditions for sensitivity testing are based on the needs of the particular project and conducted as an optional task. The types of sensitivity tests includes:

- **Traffic Forecast Sensitivity.** Traffic volumes can be increased or decreased to determine the capacity of the alternative and to determine break points in the system. It is possible that the proposed design at the break point and a small percentage increase in traffic causes failure. Identifying these break points could be used to refine the design.
- **Weaving Sensitivity.** The percentage of weaving traffic is typically estimated in simulation projects. Altering the weaving percentages can be used to identify the sensitivity of the design to weaving traffic.

- 
- **Design Sensitivity.** Simulation models can be used to evaluate the effects of the design with and without auxiliary lanes or with different storage lanes and/or lengths can be conducted to fine tune the design.

## **2.2 CORSIM Modeling Schedule**

A generic schedule for a CORSIM modeling project by major tasks has been developed as a guide to understanding the scoping process (Figure 5). This scope may not have all of the subtasks that are required so the work breakdown schedule needs to be considered on a project-by-project basis. The length of the project will be dictated by the size and complexity of the project. However, for most projects, this process will be between three and six months.

### **2.2.1 Pitfalls in Modeling Process**

Complex systems interchange areas usually involve unusual design and operational characteristics that are difficult to model. In these cases, you need to account in the budget and schedule that recoding of parts of the model may be required. The standard coding templates included in this manual may not apply to the unusual circumstances. There have been a number of projects in the Twin Cities metro area where unusual conditions required special coding that was **not** fully understood until the modeling was prepared. These projects are a valuable resource and are available for review. The projects include: I-694/I-35E interchange (unweave the weave area), the I-35W/TH 62 Crosstown Commons, and the Lake St. access project, and the coding of the I-35W/I-94 downtown commons area.

# CORSIM Modeling Schedule

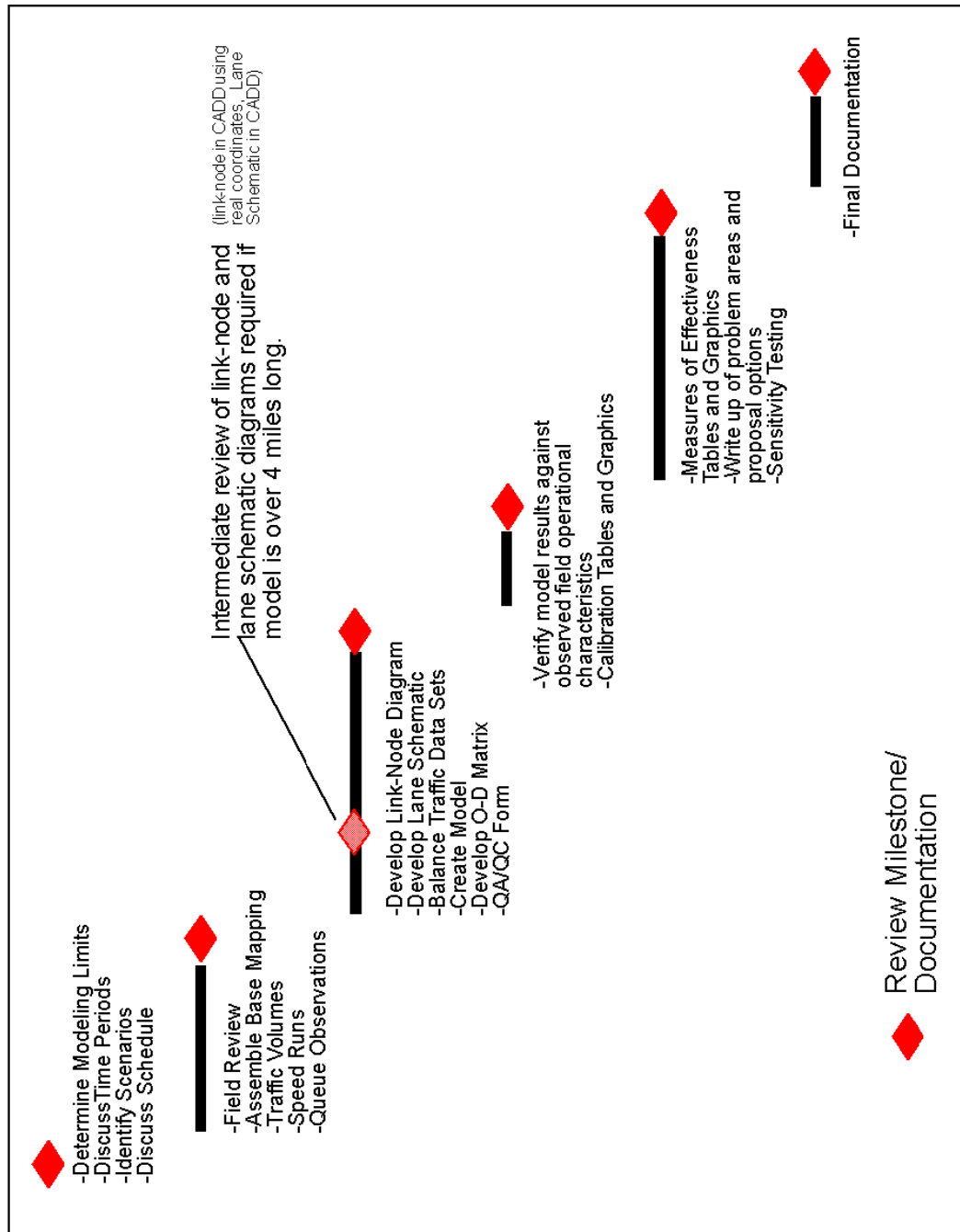


Figure 5 – CORSIM Modeling Schedule